(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 798 515 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
01.10.1997 Bulletin 1997/40

(51) Int. Cl.6: **F23Q 7/00**

(21) Application number: **97104956.4**

(22) Date of filing: **24.03.1997**

(84) Designated Contracting States:
DE FR GB

(30) Priority: **29.03.1996 IT TO960240**

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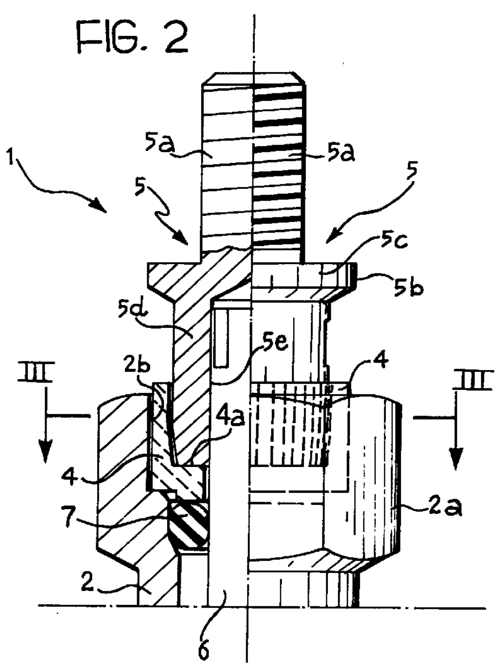
(54) Incandescent heater plug, particularly for diesel engines

(57) The incandescent heater plug (1) comprises a metal outer body (2) of essentially tubular shape, one end of which is formed with a seat (2b) in which one end (5d) of an electrically conductive terminal (5) is located with the interposition of an annular element (4) of electrically insulating material. The end (5d) of the terminal (5), the intermediate annular element (4) and the seat (2b) in the outer metal body (2) are shaped and/or coupled so that they are at least to a partial extent torsionally rigid with each other.

FIG. 2



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Description

The present invention relates to an incandescent heater plug, particularly for diesel engines, comprising a substantially tubular metal body having a seat in one end in which one end of an electrically conductive connector terminal is located with the interposition of an electrically insulating annular element, the terminal having a threaded spigot at its end remote from the body for connection to a power supply conductor through a nut element screwed onto the threaded spigot;

a metal sheath fixed to the body and having a closed end which projects from that end of the body opposite the terminal,

one resistive heating element housed in the sheath and connected to the sheath, and

an electrically conductive shaft which extends through the body and the sheath, being spaced from both of these and which has one end fixed to the terminal and its other end connected to the resistive heating element.

Incandescent plugs of the type defined above are known in which the conductive shaft interposed between the connector terminal and the resistive heating element has one end introduced into a seat provided in that part of the connector terminal opposite its threaded spigot. The conductive shaft is fixed in the connector terminal by clinching or upsetting of the wall of the seat on the end of the shaft.

The electrically insulating annular element is simply interposed between the connector terminal and the outer metal body of the plug.

When a nut or female threaded member is screwed onto a connector terminal of a plug of this type to clamp a power supply conductor to it, the torque transmitted to the connector terminal may release the conductive shaft from the connector terminal or break the shaft which is typically of untempered steel.

In order to avoid, or at least limit, the occurrence of such problems, it is necessary to take particular care in the fixing of the conductive shaft in the connector terminal.

Moreover, in order to prevent the shaft from breaking, it may be made from tempered steel. This solution however has the disadvantage that requires an additional manufacturing step (for the tempering); moreover, shafts are usually made by cutting to length from a steel bar. If this bar is of tempered steel it is extremely difficult to cut it into pieces to form the individual shafts.

The object of the present invention is, therefore, to provide an incandescent plug of the type defined above which overcomes the disadvantages indicated above without the use of a tempered metal shaft and in such a manner that the torque applied to the connector terminal does not cause this terminal to become disconnected from the associated metal shaft.

This and other objects are achieved according to the invention by an incandescent heater plug of the type specified above, characterised in that the said one end of the connector terminal, the annular insulating element and the said seat in the outer metal body of the plug are shaped and/or coupled together so as, at least to a partial extent, to be torsionally rigid with each other so that a torque applied by the screw-clamping member to the connector terminal can be at least partly discharged to the outer metal body of the plug through the intermediate insulating element between the connector terminal and the metal body.

Further characteristics and advantages of the invention will become apparent from the detailed description which follows, given purely by way of non-limitative example, with reference to the appended drawings, in which;

Figure 1 is a partly sectioned side view of an incandescent plug according to the invention,
Figure 2 is a view of part of the plug of Figure 1 without the clamping nut and on an enlarged scale;
Figure 3 is a sectional view taken on the line III-III of Figure 2;
Figure 4 is similar to Figure 2 and shows part of the plug of Figure 1 with the nut screwed onto the connector terminal of the plug;
Figure 5 is similar to Figure 2 and shows a variant of a plug of the invention; and
Figure 6 is a sectional view taken on the line VI-VI of Figure 5.

With reference to Figure 1, an incandescent plug 1 according to the present invention comprises an outer metal body 2 of essentially tubular shape in which a metal sheath 3 is partly inserted. The end 3a of the metal sheath 3 which projects out of the body 2 is closed.

The metal sheath 3 is firmly retained in the outer metal body 2 as a result of their coupling by interference fit.

At its opposite end from the sheath 3, the outer metal body has an end 2a which is formed with a seat 2b. A bush 4 of electrically insulating material is arranged in this seat. This bush may be formed, for example, from a polyamide or polypropylene material, possibly with a glass fibre filler.

A connector terminal made from metal is indicated 5.

At its end remote from the metal body 2, the connector terminal 5 has a threaded spigot 5a. The intermediate portion of the terminal 5 is formed with an annular rib 5b which defines a radial shoulder 5c (see for example Figure 2).

At its end opposite the threaded projection 5a, the terminal 5 has an end 5d of essentially tubular shape which defines a seat indicated 5e.

In the assembled condition, the lower end of the terminal 5 bears on a shoulder 4a defined within the insulating member 4 (Figure 2).

One end of a metal shaft 6 is inserted in the seat 5e in the terminal 5. The tubular portion 5d of the terminal

5 is upset or clinched on the end of the shaft 6 so that the latter is firmly fixed to the terminal.

The shaft 6 extends axially through the metal body 2 and through part of the metal sheath 3, being spaced from both of these.

An annular sealing washer 7 is located adjacent the insulating element 4, between the shaft 6 and the metal body 2.

At least one resistive heating coil 8 have an essentially helical shape is local within the metal sheath 3. The heating coil 8 is connected (for example by welding) to the sheath 3 adjacent its tip 3a.

The other end of the heating coil 8 is connected to the metal shaft 6.

An electrically insulating material 9, constituted, for example, by magnesium oxide powder, is compacted in the metal sheath 3 as well as in the space between the metal shaft 6 and the sheath.

In use, the incandescent plug 1 is mounted in a seat in an internal combustion engine, typically a diesel engine, by the screwing of a threaded portion 2c of the metal body 2 into a correspondingly threaded aperture or seat in the engine. As a result of this coupling, the metal body 2 of the plug 1 is connected to the earth of the vehicle's electrical system.

In order to supply power to the resistive heating coil 8, the connector terminal 5 of the plug is connected to a supply and control circuit (not illustrated) through a conductor indicated 10 in Figures 1 and 4. This conductor comprises, in known manner, a strip or plate formed with an aperture 10a (Figure 4). This metal plate is slipped onto the threaded spigot 5a of the connector terminal 5 of the plug so that it bears against the annular shoulder 5c. A clamping nut, shown at 11 in Figures 1 and 4, is then screwed onto the threaded spigot 5a.

In accordance with the invention, the end 5d of the connector terminal 5, the annular insulating element 4 and the seat 2b in the outer metal body 2 are shaped and/or coupled together so that they are at least, to a partial extent, torsionally rigid with each other so that the torque applied by the clamping nut 11 to the connector terminal 5 is at least partly discharged to the outer metal body 2 through the intermediate insulating member 4.

This may be achieved in various ways, some of which will be described below.

By virtue of the fact that the terminal 5 is made at least partially torsionally rigid with the outer metal body 2, the torque applied by the clamping nut 11 to the connector terminal 5 does not act, or is not discharged, solely on the junction between this connector terminal and the metal shaft 5.

This avoids the problems described at the beginning of the present description.

A first manner of rendering the terminal 5 at least partially torsionally rigid with the outer metal body 2 consists, for example, in the provision of the outer surface of the portion 5d of the terminal 5 and the inner surface of the insulating element 4 with respective longitudinal splines, whereby corresponding ridges are formed between them, the outer profile of the portion 5d of the terminal 5 being substantially complementary to the inner profile of the insulating element 4. Similarly, the outer surface of the insulating element 4 and the inner surface of the seat 2b in the outer metal body 2 are made with respective, essentially complementary, splined profiles.

This solution is illustrated in Figures 2 to 4.

When the nut 11 is screwed down tightly onto the connecting bus bar 10 (Figure 4), the torque applied to the connector terminal 5 is transmitted at least partly to the outer metal body 2 through the intermediate insulating element 4, reducing the torsional stress at the interface between the terminal 5 and the metal shaft 6.

A variant is shown in Figures 5 and 6.

In this variant, the spigot 5d of the connector terminal 5, the intermediate insulating element 4 and the seat 2b in the outer metal body 2 have respective polygonal shapes, in complementary pairs, as shown in Figure 6.

In a further variant (not illustrated), the outer surface of the spigot 5d of the connector element 5, the inner and outer surfaces of the annular insulating element 4 and the inner surface of the seat 2b in the metal body 2 may be formed with respective threads so that, once screwed together, these elements are substantially torsionally rigid with each other.

Obviously, numerous other variants may be adopted by experts in the art in order to render the elements 2, 4 and 5 substantially torsionally rigid with each other.

For example the terminal 5, the insulating bush 4 and the body 2 may be made at least partially rigid by their mutual coupling by interference fit, or driving.

The intermediate insulating element 4 may be a preformed element or may be made from a plastics material by hot casting or injection in the interspace between the portion 5d of the connector terminal 5 and the wall of the seat 2b in the outer metal body 2.

Naturally, the principle of the invention remaining the same, the forms of embodiment and details of construction may be varied widely with respect to that described and illustrated purely by way of non-limitative example, without thereby departing from the scope of the invention as defined in the appended claims.

Claims

1. An incandescent heater plug (1), particularly for diesel engines, comprising:

    a substantially tubular metal body (2) having a seat (2b) in one end in which one end (5d) of an electrically conductive connector terminal (5) is located with the interposition of an electrically insulating annular element (4), the terminal having a threaded spigot (5a) at its end remote from the body (2) for connection to a power supply conductor (10) through a nut element

(11) screwed onto the threaded spigot (5a);

a metal sheath (3) fixed to the body (2) and having a closed end (3a) which projects from that end of the body (2) opposite the terminal (5),

at least one resistive heating element (8) housed in the sheath (3) and connected thereto, and

an electrically conductive shaft (6) which extends through the body (2) and the sheath (3), being spaced from both of these, and which has one end fixed to the terminal (5) and its other end connected to the resistive heating element (8),

characterised in that the said one end (5d) of the terminal (5), the annular insulating element (4) and the said seat (2b) in the metal body (2) are shaped and/or coupled together so as, at least to a partial extent, to be torsionally rigid with each other so that a torque applied by the screw-clamping member (11) to the connector terminal (5) can be at least partly discharged to the metal body (2) through the intermediate insulating element (4).

2. An incandescent plug according to Claim 1, characterised in that the outer surface of the connector terminal (5), the inner surface of the insulating element (4) and/or the outer surface of the insulating member (4) and the inner surface of the seat (2b) in the metal body (2) have respective essentially complementary, for example polygonal, geometric shapes.

3. An incandescent plug according to Claim 1 or 2, characterised in that the outer surface of the connector terminal (5) and the inner surface of the insulating element (4) and/or the outer surface of the insulating element (4) and the inner surface of the seat (2b) in the metal body (2) have respective sets of coupling splines whereby they are substantially torsionally rigid.

4. An incandescent plug according to any one of the preceding claims, characterised in that the outer surface of the connector terminal (5) and the inner surface of the insulating element (4) and/or the outer surface of the insulating element (4) and the inner surface of the seat (2b) in the metal body (2) have respective complementary threads screwed together so that they are substantially torsionally rigid.

5. An incandescent plug according to any one of the preceding claims, characterised in that the connector terminal (5), the insulating element (4) and the metal body (2) are coupled together by interference fit.

6. An incandescent plug according to Claim 1, characterised in that the intermediate insulating element (4) is made from a plastics material by hot casting or injection in the seat (2) in the metal body (2).

FIG. 1

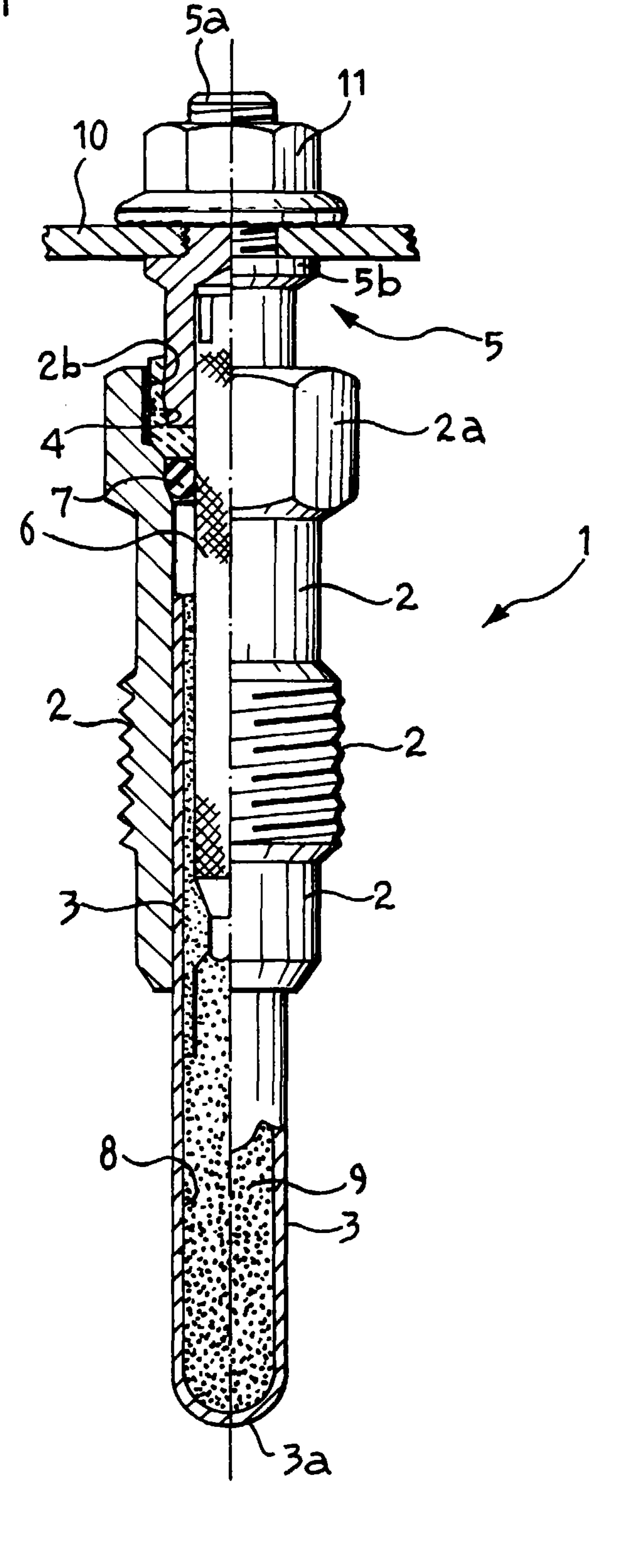

FIG. 2

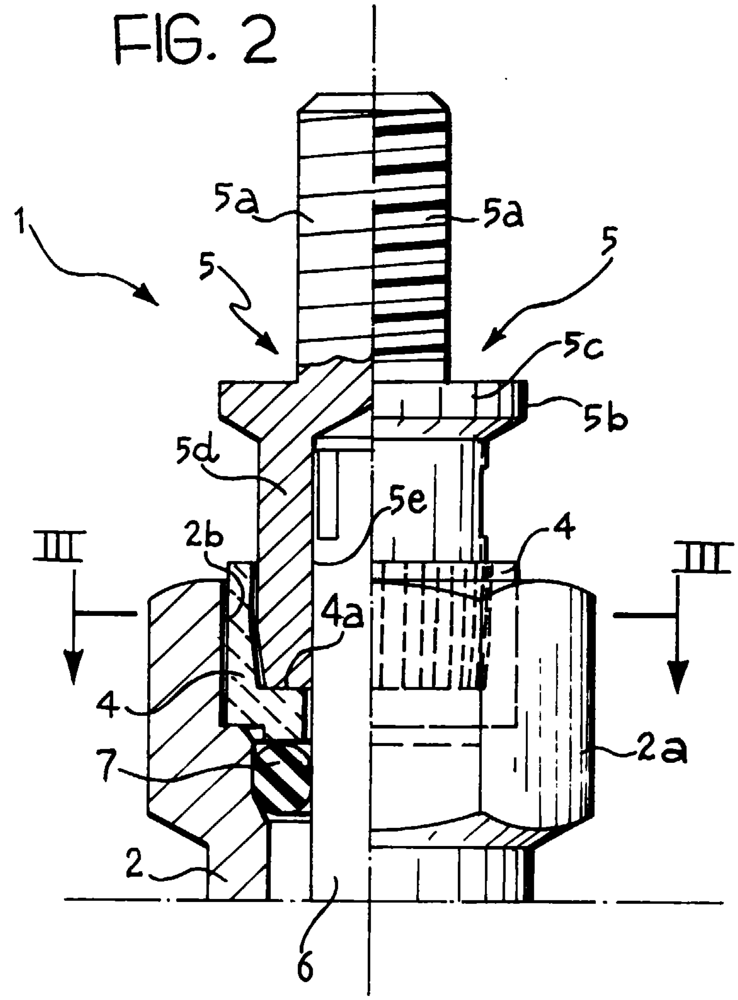

FIG. 3

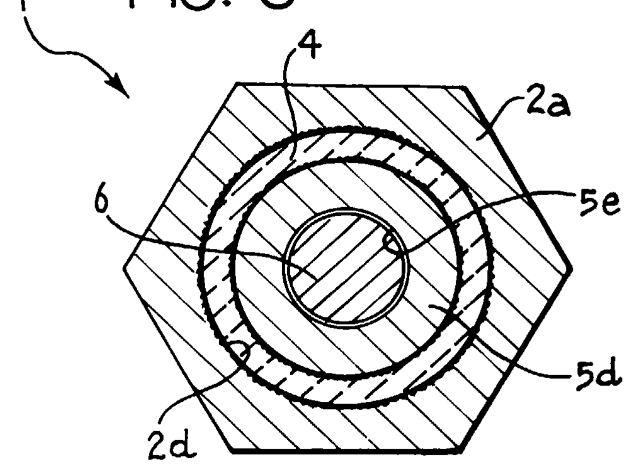

FIG. 4

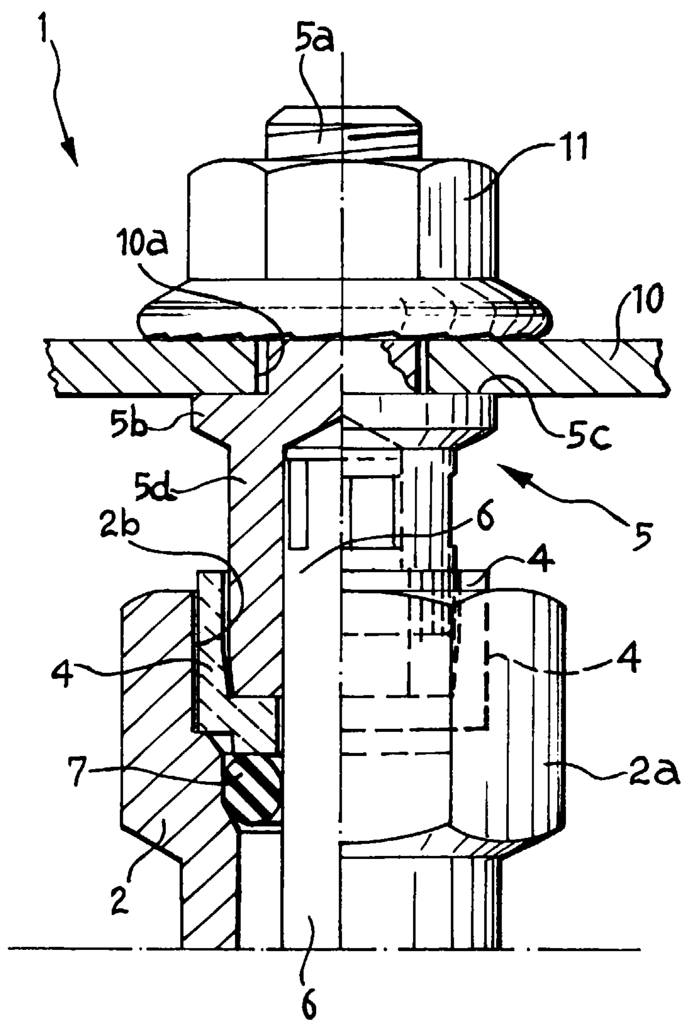

FIG. 5

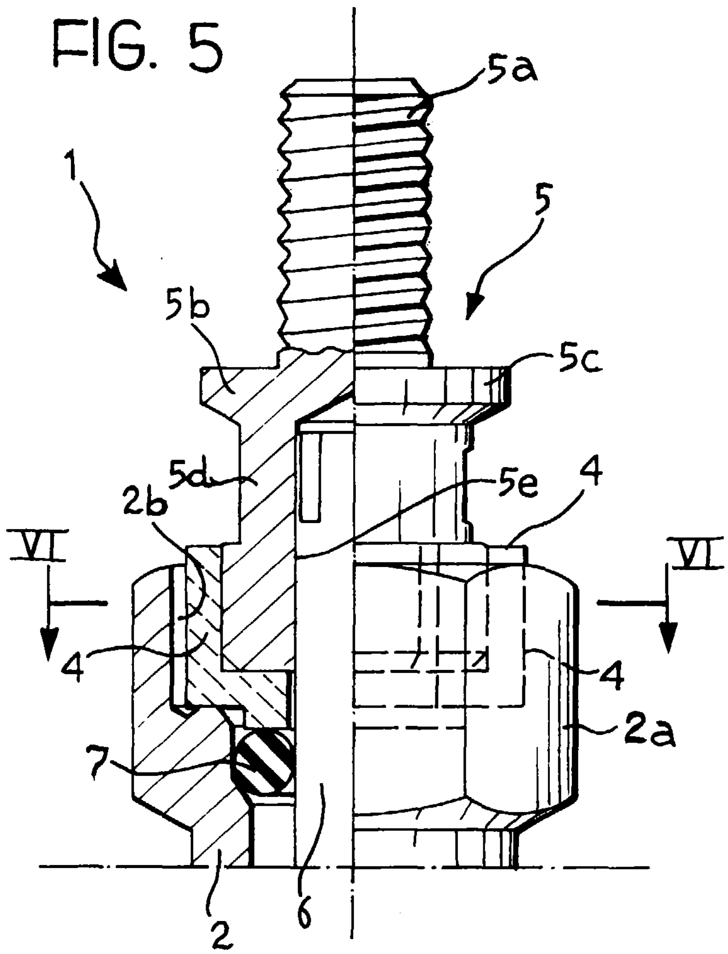

FIG. 6